

This lesson is part of a larger, comprehensive school garden guide called **Minnesota School Gardens: A Guide to Gardening and Plant Science** developed by Minnesota Agriculture in the Classroom in 2013. The entire guide is available at [www.mda.state.mn.us/maitc](http://www.mda.state.mn.us/maitc).



## Grade

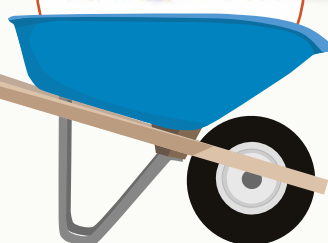
Middle School

### Materials/Preparation

- ☐ Teacher Material A – Basic Plant Requirements (Venn Diagram) – one per teacher
- ☐ Teacher Material B – Basic Plant Requirements – one per teacher
- ☐ Teacher Material C – Basic Photosynthesis – one per teacher
- ☐ Handout A – Basic Plant Requirements – one per student
- ☐ Handout B – Minnesota Plant Hardiness Zone Map – one per student
- ☐ Assessment A – Plant Needs – one per student
- ☐ Venn Diagram on board or overhead transparency
- ☐ Writing instruments

### Fun Fact

"Green" beans can actually be green, yellow, purple, or speckled in these colors.



# Plant Needs

## Minnesota K-12 Academic Standards

Science	7.4.2.2	The flow of energy and the recycling of matter are essential to a stable ecosystem.
Language Arts	6.13.7.7	Compare and integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, table, map).

### Summary/Overview

Students compare their needs to the needs of plants using a Venn diagram. They also learn about the process of photosynthesis.

### Garden Connection

Without light, air, water, and a growing media plants would not survive.

### Background Information

*Photosynthesis* is the process by which plants make their energy. Photosynthesis occurs when light, carbon dioxide, and water are converted into energy for the plant.

### Objectives

- Identify four basic plant requirements.
- Explain the importance of each plant requirement.
- Compare and contrast the needs of humans and plants.

### Procedure

#### Interest Approach

Students will complete a Venn diagram (refer to Teacher Material A) that will eventually compare and contrast the students' needs to the needs of plants. First have students write down all of the things they need to survive in the first circle that is labeled MY NEEDS. Share their responses with the class as you record their answers on the transparency or on a replicated Venn diagram drawn on a board.

#### Summary of Content and Teaching Strategies

Move into discussing what plants need to grow. For this part of the lesson, students need a copy of Handout A and a pencil. Use Teacher Material B to help guide the lesson and provide a visual reference as students take notes. Also, ensure that you have Teacher Material C available. First, students must understand the process of photosynthesis and how this process dictates what plants need to grow.

While we rely on food sources such as fruits, vegetables, and meats to provide energy, plants are able to produce their own “food” through a process called *photosynthesis*. Show the class Teacher Material C. *Photosynthesis* is the process by which plants use carbon dioxide from the air, water from the soil, and light to create energy that plants need to live, grow, and reproduce.

Take a closer look at the four major plant requirements. As you go over each of these needs, students place them on the Venn diagram in the circle labeled “Plant Needs.” As you discuss the basic plant requirements, display Teacher Material B and Teacher Material C.

## Review/Summary

Review the four basic plant needs. Allow students time to review both outside circle lists and write common needs in the center of the Venn diagram. Both plants and humans need air and water to survive. Without plants, humans would not have oxygen or food. Only plants are able to convert energy from the sun into food products usable for animals and humans.



### Sources/Credits

Adapted from: National FFA Organization *Middle School Food and Agricultural Literacy Curriculum*, sponsored by the National Pork Board as a special project of the National FFA Foundation. Visit [www.ffa.org/documents/learn/MS.PS.1.2.pdf](http://www.ffa.org/documents/learn/MS.PS.1.2.pdf) to access the full-length version of this lesson.

## Modifications/Extensions

The United States Department of Agriculture (USDA) has developed a map to assist gardeners when selecting plants. The map reflects the average extreme minimum temperature by zone using data from 1976–2012. Gardeners use zone information to select plants that will thrive in their climate. This is especially important for perennial plants that over-winter. Provide students with copies of Handout B. Discuss the map and answer the questions.

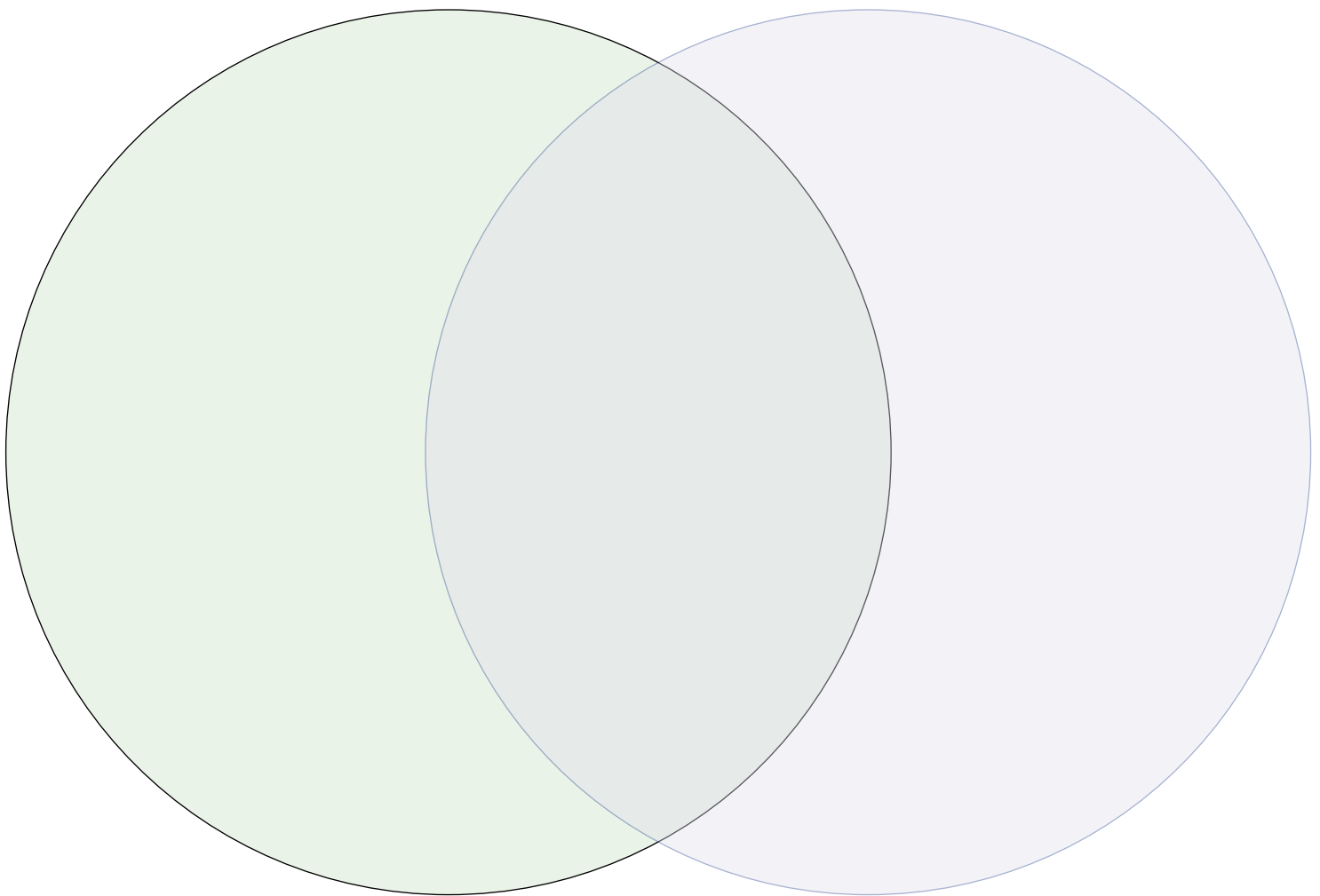


Conduct a two-week experiment with the class. You'll need four identical plants, a clear nonporous bag, and a very dark closet or room. On day one, show the class the four identical plants. Place one plant in the nonporous bag and label it AIR. Place the second plant in a very dark room or closet and label it LIGHT. Label third plant WATER; do not water this plant for the entire length of the experiment. Put fourth plant in an area with plenty of light and air and label it CONTROL. Water the CONTROL plant every day or as needed. Have the class observe the plants about every two days and document changes in the different plants. By the end of two weeks, the three plants that were restricted from light, water, and air will be dead or close to dead. Discuss these results with the class.

# Basic Plant Requirements

MY NEEDS

PLANT NEEDS





# Basic Plant Requirements

## A. Light

1. Light is required for photosynthesis.
2. Light is the energy that powers the photosynthetic process.
3. Light can either be natural or artificial.
  - a. Natural Light – light from the sun. The sun is the most important energy source in the world as all of our food products (even meat and eggs) ultimately rely on the sun's energy.  
Ex: Steaks come from cattle that eat plant matter, which was grown using the sun's energy.
  - b. Artificial Light – Plants can also use artificial light for the process of photosynthesis. Artificial light is light from bulbs and other human-made sources. Artificial light can be used to manipulate plants to flower, fruit, or germinate at specific times.

## B. Air

1. Plants must have plenty of air to perform photosynthesis and to live.
2. During photosynthesis, plants absorb carbon dioxide and release oxygen.
3. Plants are important to our survival and the health of the earth because they convert harmful carbon dioxide into the oxygen we breathe.

## C. Water

1. All living organisms, including plants, require water to live.
2. Water is essential for the process of photosynthesis.
3. Also, plants use water to transport minerals and nutrients from the roots to the rest of the plants and the energy created by photosynthesis from the leaves back down to the roots.

## D. Growing Media

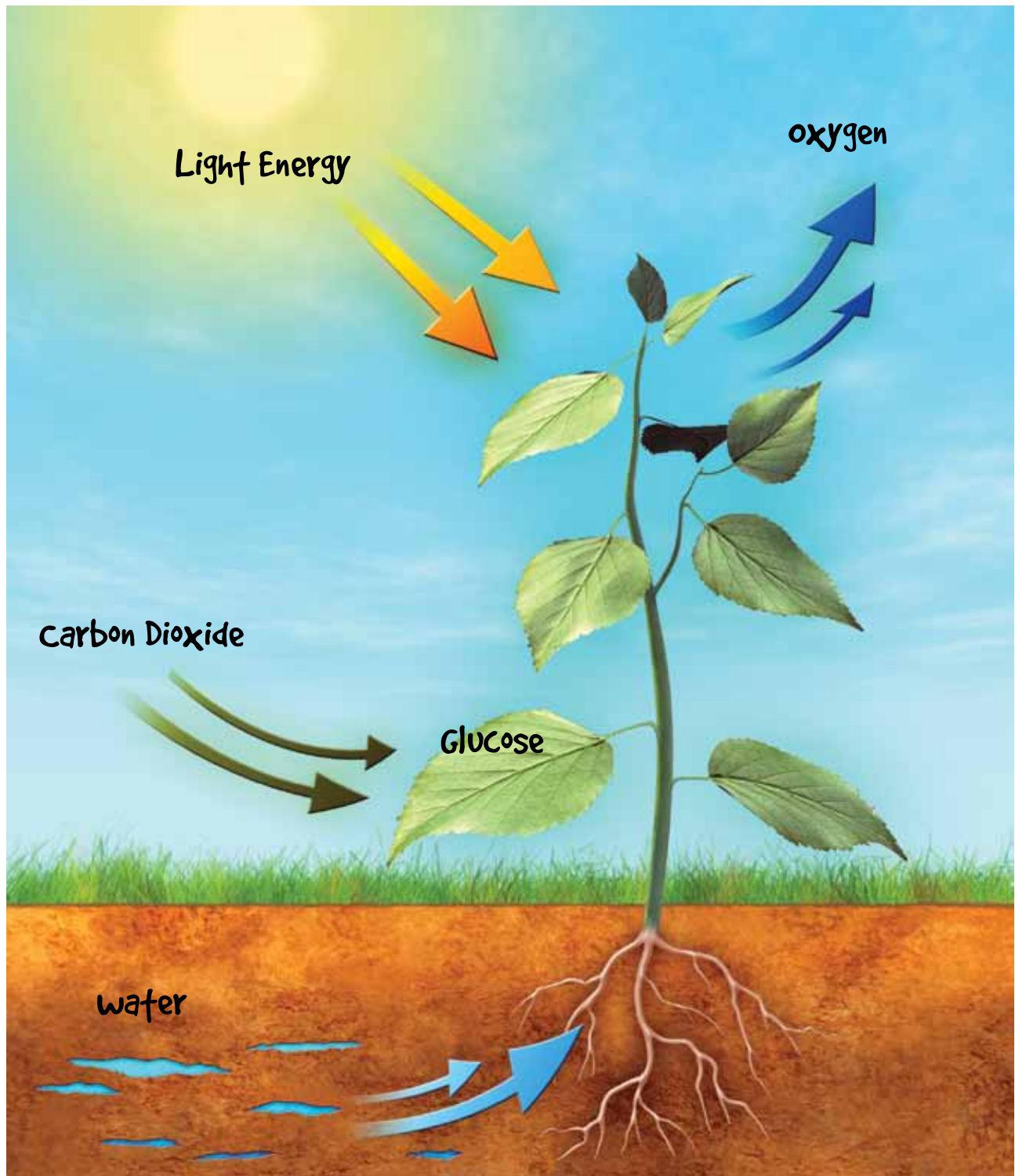
1. Plants require a medium to anchor the plant and provide minerals.
2. Soil
  - a. Plants are most commonly grown in soil.
  - b. Plants anchor themselves in the soil using their roots.
  - c. Soil provides water and nutrients for the plants.
3. Soilless Media
  - a. In greenhouses, plants are commonly grown in soilless medium.
  - b. Soilless medium may contain moss, perlite, vermiculite, sand, and bark.
  - c. Soilless media is effective because it is sterile.
4. Hydroponics
  - a. Hydroponics is the practice of growing plants in the absence of soil, using just water and nutrients.
  - b. In large greenhouse operations, hydroponics reduce the amount of water needed and wasted by ensuring that all of the water reaches the roots.

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When plant needs are met, they are able to carry out the process of **Photosynthesis**:

1. The process by which plants make their energy (food in the form of glucose).
2. Most photosynthesis occurs in the leaves of the plant because they have the greatest surface area to collect the most light.
3. Photosynthesis occurs when light, carbon dioxide, and water are converted into energy for the plant.

# Basic Photosynthesis



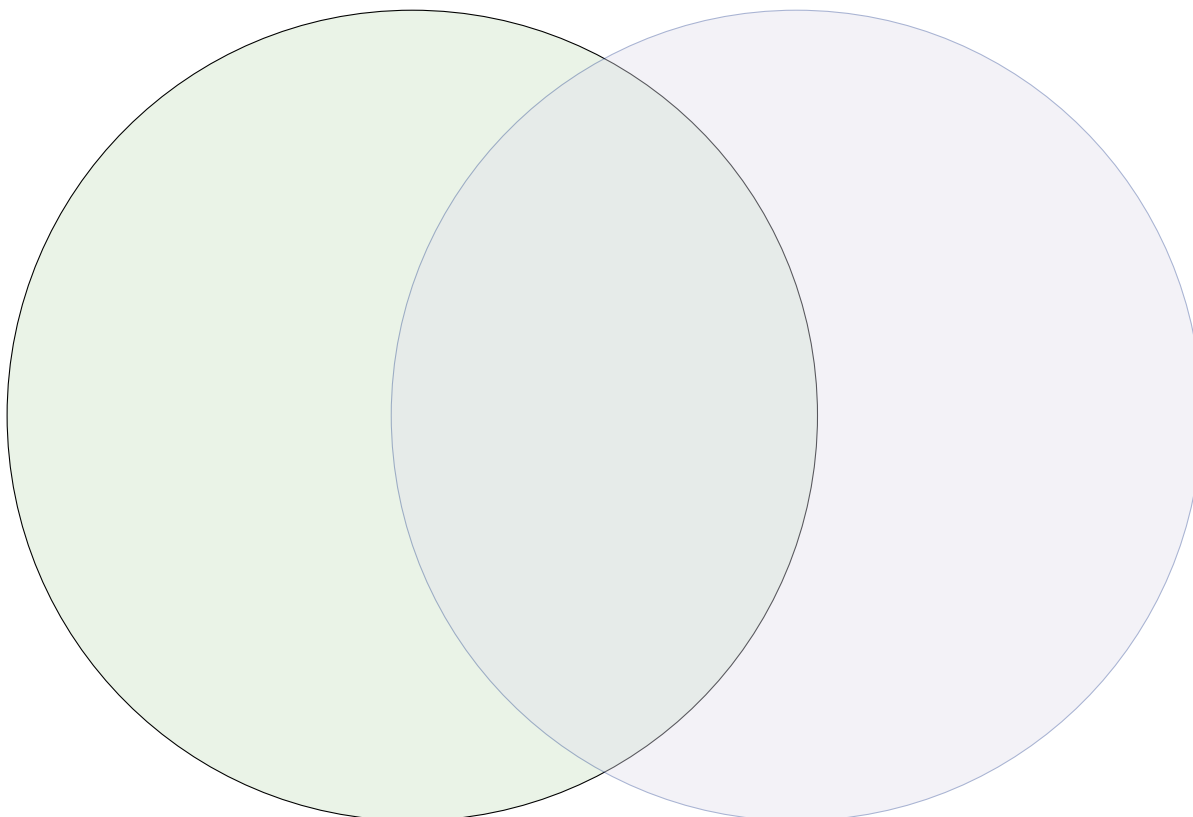
Name \_\_\_\_\_



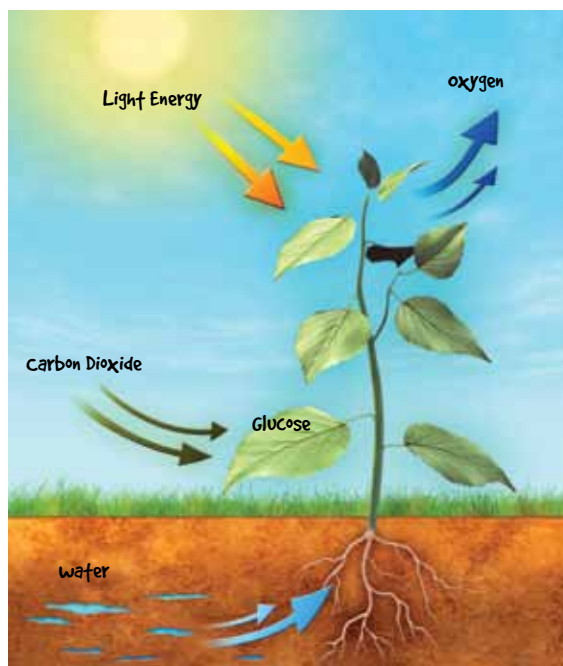
# Basic Plant Requirements

MY NEEDS

PLANT NEEDS



## The Process of Photosynthesis



Name \_\_\_\_\_



# Minnesota Plant Hardiness Zone Map

Find the county where you live and place a star in the location of your town. In which plant hardiness zone do you live?

\_\_\_\_\_

What is the average annual extreme minimum temperature in F° for your zone?

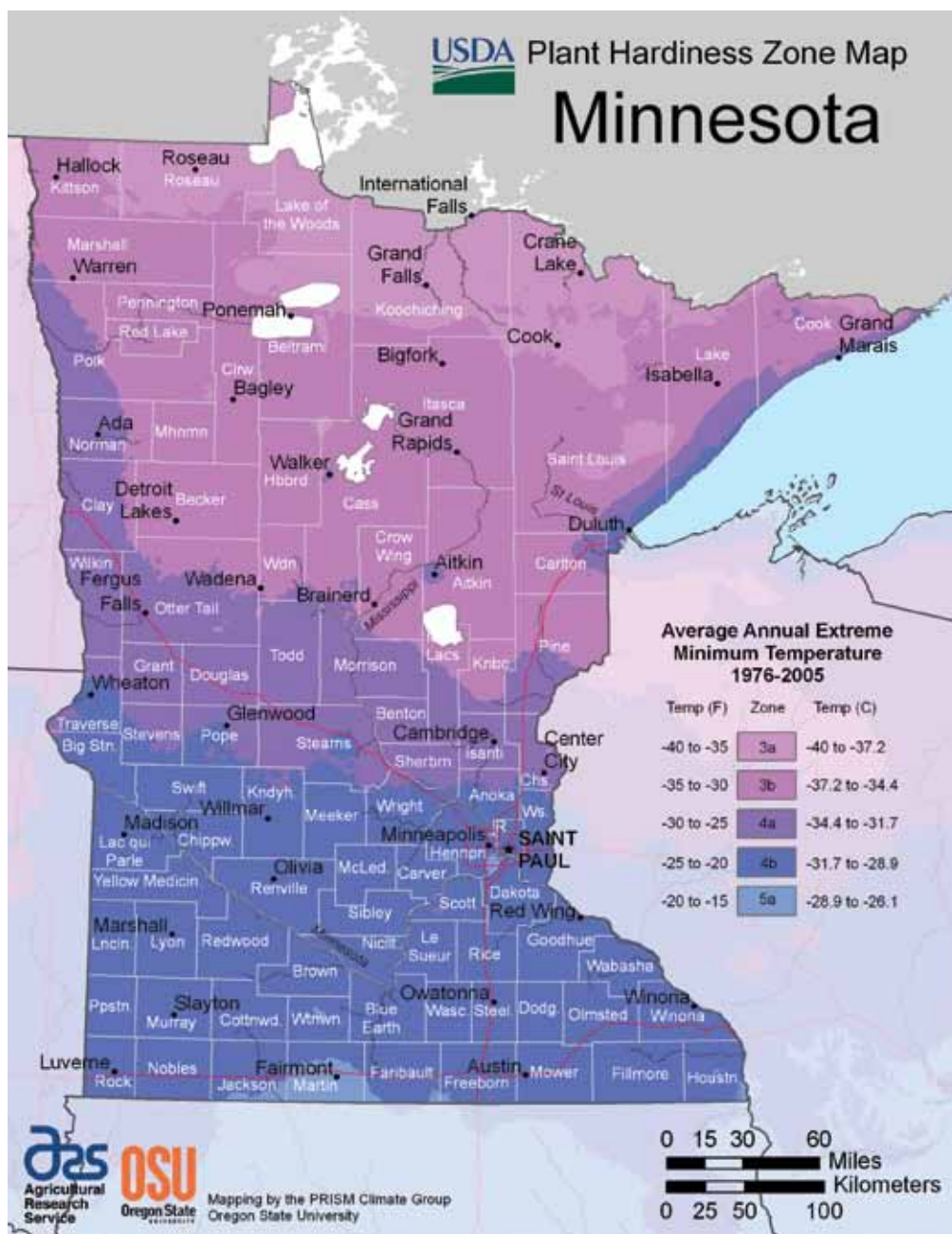
\_\_\_\_\_

What part of the state has the coldest temperatures?

\_\_\_\_\_

What part has the warmest temperatures?

\_\_\_\_\_



Source: <http://planthardiness.ars.usda.gov>

Why do you think the land near Lake Superior is warmer than other places in the northeast corner of Minnesota?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



Name \_\_\_\_\_



# Plant Needs

Using the word bank below, answer the questions below by filling in the blanks.  
Each word will only be used once.

## Word Bank

Photosynthesis   carbon Dioxide   oxygen   Hydroponics   Artificial   Leaves

\_\_\_\_\_ are the primary site of photosynthesis in plants.  
This is where plants gather the most sunlight to be converted to energy.

\_\_\_\_\_ is the practice of growing plants in water with  
the absence of soil or any other growing media.

During photosynthesis, plants take in \_\_\_\_\_ from the  
air and release \_\_\_\_\_ which humans breathe.

While most plants and crops grow using the sun's light, \_\_\_\_\_  
light, such as light bulbs, is often used in greenhouse operations.

Plants convert carbon dioxide, water, and energy from the sun to produce all of  
the energy they need to grow and reproduce through a process called

\_\_\_\_\_.